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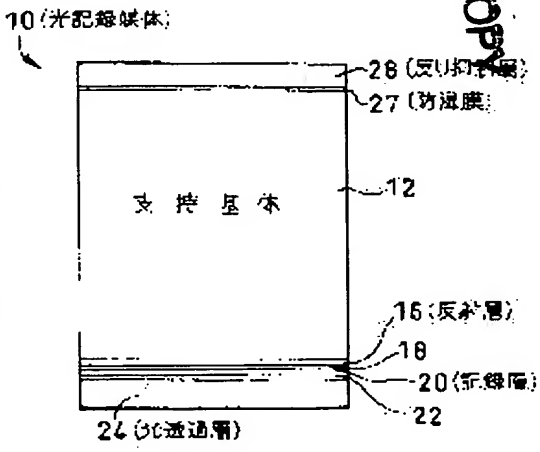
(54) OPTICAL RECORDING MEDIUM

(57)Abstract:
PROBLEM TO BE SOLVED: To suppress warpage of an optical recording medium based on expansion and contraction of a light transmission layer due to steep change of temperature in the optical recording medium having a comparatively thick light transmission layer together with a supporting substrate.
SOLUTION: An optical recording medium 10 is formed by providing a reflection film 16, a recording layer 20 and a light transmission layer 24 consisting of an acrylic resin having about 100 μm thickness on a supporting substrate 12 made of polycarbonate and a warp suppressing layer 28 formed on the surface opposite thereto of the supporting substrate 12 and the expansion and the contraction of the light transmission layer 24 and the expansion and the contraction of the warp suppressing layer 28 due to the steep change of temperature are cancelled out each other.



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CLAIMS

[Claim(s)]
[Claim 1] The optical recording medium characterized by being the optical recording medium with which the information recording surface formed in the support base is worn, and the light transmission layer is prepared at least, and the variation of the amount of curvatures of the optical recording medium by the rapid temperature change being less than 0.4 degrees.
[Claim 2] The optical recording medium with which the maximum variation of the amount of curvatures of an optical recording medium to said rapid temperature change is characterized by being the following by /0.2 degrees in claim 1.
[Claim 3] The optical recording medium characterized by the thickness of a light transmission layer being 20-130 micrometers in claim 1 or 2.
[Claim 4] The optical recording medium characterized by what was constituted in claims 1 and 2 or 3 by the quality of the material from which the coefficient of linear expansion of said light transmission layer and said support base differs.
[Claim 5] It is the optical recording medium characterized by what said light transmission layer was constituted for in claims 1 and 2 or 4 by the quality of the material with the larger coefficient of linear expansion than said support base.
[Claim 6] claim 1 -- moreover -- or the optical recording medium characterized by said light transmission layer consisting of energy-line hardening mold resin or heat ray hardening mold resin in either of 6.
[Claim 7] It is the optical recording medium characterized by said support base consisting of a polycarbonate or polyolefine in claim 1 thru/or either of 6.
[Claim 8] It is the optical recording medium characterized by being the variation of the amount within 60 minutes of curvatures after change of the amount of curvatures to the temperature change of said optical recording medium is taken out from the ambient atmosphere of temperature gradient at least 30 degrees C or more in claim 1 thru/or either of 7.
[Claim 9] The optical recording medium characterized by the thing of said support base performed for the curvature control means at least in claim 1 thru/or either of 8 in the field of said light transmission layer and opposite side.
[Claim 10] It is the optical recording medium characterized by for said curvature control means consisting of said light transmission layer in said support base, and a curvature control layer prepared in the field of the opposite side in claim 9, and this curvature control layer consisting of ingredients with which the product of coefficient of linear expansion and thickness becomes 0.3 to 1.7 times to the coefficient of linear expansion of said light transmission layer, and the product of thickness.
[Claim 11] The optical recording medium characterized by making the same the ingredient of said light transmission layer, and the ingredient of said curvature control layer in claim 9 or 10.
[Claim 12] The optical recording medium characterized by forming a damp proof course between said curvature control layers and said support bases in claims 9 and 10 or 11.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to an optical recording medium.
[0002]
[Description of the Prior Art] in the condition (initial state) of having been manufactured, optical recording media (disk), such as the conventional CD (Compact Disc) and DVD (Disital Versatile Disc), are manufactured so that it may become in the specification the property (an electrical property and mechanical characteristic) was variously decided to be -- having -- further -- a long period of time -- a guarantee of dependability sake -- accelerated test order, such as a high-humidity/temperature preservation test, -- the aggravation degree of a property is also specified variously. It is required as one of the indexes of dependability over a long period of time [this] that the variation of the amount of curvatures of the entire disk in accelerated test order should be less than constant value. Such conventional CD, conventional DVD, etc. consist of a light transmission nature substrate (light transmission layer) which mainly consists of a polycarbonate. The main cause of curvature Said polycarbonate substrate, A recording layer, a reflecting layer, a protective layer, and at least when are constituted possible [record], and it is constituted further only for playbacks, at least A reflecting layer and a protective layer, The accelerated test (high-humidity/temperature and accelerated test only according to an elevated temperature or a highly humid chisel) was carried out as a trial which checks dependability over a long period of time [since / said] by the balance of the stress by telescopic motion of **, and sufficient management was carried out.
[0003] On the other hand, a record playback layer is prepared in record and/or a refreshable condition on a support base, a light transmission layer is formed on it, and the optical disk (optical recording medium) it was made to irradiate the laser beam which performs record/playback from this light transmission layer side is proposed so that it may be indicated by JP,1996-235638,A.
[0004] Here, the case where the film made of resin is prepared through a glue line as said light transmission layer is proposed, and the proposal at the time of preparing the resin layer of an energy-line hardening mold or a heat ray hardening mold with a spin coat method is also made to others. In these, I thought that it was for expanding as main causes by which generating and stress balance of curvature collapse when a resin layer absorbs moisture, the stress relaxation of each class, and.
[0005]
[Problem(s) to be Solved by the Invention] However, this invention persons discovered that change of the big amount of curvatures occurred immediately after said accelerated test, when the quality of the material of said light transmission layer was [the thickness of a light transmission layer] 20 micrometers or more further unlike the quality of the material of said base material.
[0006] With change of the big amount of curvatures of an immediately after [this accelerated test] When it takes out after elevated-temperature preservation and cold storage (for example, 80-degree-C 12 hours) (0-degree-C 12 hours) and the amount of curvatures is measured in a room temperature environment, it is what changes steeply for a short time. Generating of the steep curvature in such a short time For example, the time of carrying an optical recording medium into the room whose air conditioning was suddenly effective against the hot day of summer from outside, The trouble that it is high, and possibility of generating when an optical recording medium is suddenly carried into the warm room in cold winter can equip with it, or cannot use an optical recording medium for a drive for a while in this case arises.
[0007] This invention is made in view of the above-mentioned trouble, and it aims at offering the optical recording medium which controlled the curvature generated by the steep temperature change in a short time.

[0008]
[Means for Solving the Problem] Said light transmission layer wholeheartedly this invention person as a result of research In the case of the thickness more than fixed When coefficient of linear expansion differs from said base material, and a high-humidity/temperature accelerated test, Expansion by the resin by the stress balance of each class, such as curvature, a polycarbonate, and an acrylic, absorbing moisture precedes curvature generating of a cause. By discovering that there is steep curvature generating in a short time by the temperature change, and controlling steep curvature generating in this short time, even when a temperature change was steep, it found out that an optical recording medium could be made usable.
[0009] That is, the above-mentioned purpose is attained by the following invention.
[0010] (1) The optical recording medium characterized by being the optical recording medium with which the information recording surface formed in the support base is worn, and the light transmission layer is prepared at least, and the variation of the amount of curvatures of the optical recording medium by the rapid temperature change being less than 0.4 degrees.
[0011] The information recording surface said here also calls it an information record section, and the sputtering area part in the time of sputtering to a support base top being completed at least is shown.
[0012] Moreover, although an environmental change etc. was later explained to the example as the rapid temperature change variously at the detail, the temperature change 1 degree C / more than min was made into the rapid temperature change here.
[0013] (2) The optical recording medium of (1) with which the maximum variation of the amount of curvatures of an optical recording medium to said rapid temperature change is characterized by being the following by /0.2 degrees.
[0014] (3) The optical recording medium of (1) or (2) characterized by the thickness of a light transmission layer being 20-130 micrometers.
[0015] (4) The optical recording medium of (1), (2), or (3) characterized by what was constituted by the quality of the material in which coefficient of linear expansion with said base material differs from said light transmission layer.
[0016] (5) Said light transmission layer is an optical recording medium of (1) thru/or (4) characterized by what was constituted by the quality of the material with the larger coefficient of linear expansion than said support base.
[0017] (6) Said light transmission layer is the optical recording medium of either (1) characterized by consisting of energy-line hardening mold resin or heat ray hardening mold resin thru/or (5).
[0018] (7) Said support base is an optical recording medium of either (1) characterized by consisting of a polycarbonate or polyolefine thru/or (6).
[0019] (8) Change of the amount of curvatures to the temperature change of said optical recording medium is the optical recording medium of (7) characterized by being the variation of the amount within 60 minutes of curvatures after being taken out from the ambient atmosphere of temperature gradient at least 30 degrees C or more.
[0020] (9) The optical recording medium of (8) characterized by the thing of said support base performed for the curvature control means to the field of said light transmission layer and opposite side at least.
[0021] (10) It is the optical recording medium of (9) characterized by for said curvature control means consisting of said light transmission layer in said support base, and a curvature control layer prepared in the field of the opposite side in a claim, and this curvature control layer consisting of ingredients with which the product of coefficient of linear expansion and thickness becomes 0.3 to 1.7 times to the coefficient of linear expansion of said light transmission layer, and the product of thickness.
[0022] (11) The optical recording medium of (9) or (10) characterized by making the same the ingredient of said light transmission layer, and the ingredient of said curvature control layer.
[0023] (12) The optical recording medium of (9), (10), or (11) characterized by forming a damp proof course between said curvature control layers and said support bases.
[0024]
[Embodiment of the Invention] The example of the gestalt of operation of this invention is explained to a detail with reference to a drawing below.
[0025] As shown in drawing 1 , the optical recording medium 10 concerning the example of the gestalt of this operation is formed at least in order of the reflective film 16, the 2nd dielectric layer 18, a recording layer 20, the 1st dielectric layer 22, the light transmission layer 24, and **** on the support base 12 which consists of a polycarbonate (it sets to drawing 1 and is the bottom). Moreover, the moisture-proof film 27 and the curvature control layer 28 are formed in the opposite side with the light transmission layer 24 grade

of the support base 12 in this order at least.
[0026] Said support base 12 is formed by injection molding of polycarbonate resin here, and the thickness is set to about 1.1mm. Besides, said reflective film 16, the 2nd dielectric layer 18, a recording layer 20, and the 1st dielectric layer 22 are formed in this order by the sputtering method, said light transmission layer 24 comes to carry out the spin coat of the acrylic resin, and that thickness is set to about 100 micrometers.
[0027] Therefore, in conventional CD, conventional DVD, etc., said light transmission layer 24 is formed quite thickly as compared with the protection layer thickness (about 5 micrometers) on the resin layer equivalent to the location of the light transmission layer 24 of this optical recording medium 10, i.e., the reflective film.
[0028] Although said reflective film 16 will not be limited if the reflection factor demanded is filled, but it can apply various metallic materials etc., it is using Ag as the principal component here. Although various ingredients could also apply the 1st and 2 dielectric layers 22 and 18, ZnS-SiO2 was used here. Moreover, the recording layer 20 was made into the GeSbTe system which is the recording layer presentation of a phase change mold.
[0029] Said curvature control layer 28 is formed by the same ingredient (acrylic resin) as the light transmission layer 24, and almost equal thickness. Moreover, the moisture-proof film 27 prepared here consists of an aluminum layer by which sputtering was carried out, and thickness is set to 50nm.
[0030] Since said light transmission layer 24 is formed in the support base 12 made of polycarbonate resin, and one with acrylic resin as mentioned above, a rapid temperature change is in an ambient atmosphere, and when the change is large, curvature generates it for the reasons of the difference in the coefficient of linear expansion in each unit time amount etc.
[0031] In this optical recording medium 10, since the curvature control layer 28 which consists of the same acrylic resin as the light transmission layer 24 is formed in the front face (it sets to drawing 1 and is a top face) of said light transmission layer 24 and opposite side of said support base 12 by almost equal thickness, it can control by maintaining the stress balance whose each class has the variation of the amount of curvatures of the optical-recording-medium 10 whole based on telescopic motion by the temperature change of the light transmission layer 24.
[0032] It is made for the variation of the concrete amount of curvatures to serve as the range of less than 0.4 degrees from an initial state. Furthermore, specifically, the variation of said amount of curvatures is measured by the elevated-temperature retention test. After this trial throws an optical recording medium 10 into a 80-degree C ambient atmosphere and carries out aging of about 12 hours, it is taken out in 20-22 degrees C of atmospheric temperature, and the ambient atmosphere of 50 - 60% of humidity, measures the amount of curvatures like the after-mentioned, measures the variation of the amount of curvatures by the heat dissipation for [of the beginning] 0 - 20 minutes from measurement initiation, and it manages it so that said variation may become less than 0.4 degrees from that result.
[0033] Furthermore, it is made for the variation of said amount of curvatures to become a part for /0.2 degrees preferably for steep curvature control.
[0034] Said moisture-proof film 27 protects the support base 12 from moisture, controls elongation, is taken out from elevated-temperature storage environment, and controls moisture absorption of the support base 12 made from a polycarbonate after temperature falls to some extent.
[0035] Here, as shown in drawing 2 , from a laser light source 30, measurement of the variation of said amount of curvatures irradiates a laser beam to a record medium 10, receives the reflected light at that time with a semi-conductor position transducer (henceforth, PSD), and detects the amount of curvatures of an optical recording medium 10 with the incidence location to this PSD32 of a reflective laser beam.
[0036] Furthermore, when it sets to the detail so that a reflective laser beam may carry out incidence in the center of PSD32, when an optical recording medium 10 is in a direct flat-surface condition without curvature, as drawing 2 is shown by the broken line, and curvature beta arises in an optical recording medium 10, only 2xbeta increases, this serves as gap of the incidence location of the reflective laser beam of PSD32, and the angle of reflection of a reflective laser beam is detected. Let the amount of gaps to said criteria set up beforehand be the variation of the amount of curvatures.
[0037] In the example of the gestalt of this operation, as mentioned above, since the same ingredient as this and the curvature control layer 28 of the same thickness are formed in said light transmission layer 24 and opposite side of the support base 12, curvature hardly occurs by offsetting telescopic motion of these layers by the temperature change on both sides of the support base 12, and maintaining stress balance.
[0038] In addition, in the example of the gestalt of the above-mentioned implementation, although the curvature control layer 28 is formed in the same ingredient as the light transmission layer 24, and the same

thickness, this invention is not limited to this and the ingredient and thickness of the curvature control layer 28 are not limited to the example of the gestalt of the above-mentioned implementation that the variation of the amount of curvatures to the temperature change within fixed time amount should just be [therefore] within the limits of less than 0.4 degrees.

[0039] For example, since 30 percent of the curvature of this light transmission layer 24 is offset even if it is the same ingredient as the light transmission layer 24 and the thickness is about 30% of the light transmission layer 24, change of the amount of curvatures which remained should just become above-mentioned within the limits. Moreover, it is good conversely also considering the thickness of the curvature control layer 28 as about 1.7 times of the light transmission layer 24.

[0040] furthermore, although the light-transmission layer 24 is formed from acrylic resin, this invention is variously selectable out of the energy-line hardening mold resin which it is generally applied when using the intense ingredient of telescopic motion by the rapid temperature change in a short time, and is hardened with energy lines, such as ultraviolet rays, and the heat ray hardening mold resin hardened with heat, and application of acrylic resin, epoxy system resin, urethane system resin, etc. is possible for it in the example of the gestalt of the above-mentioned implementation -- certain **

[0041] Furthermore, although said curvature control layer 28 is used as the same ingredient as the light transmission layer 24, since light transmission nature is not required, this curvature control layer 28 may be other opaque or translucent ingredients again. Here, although thickness of said light transmission layer 24 is set to 100 micrometers, this invention is applied to the optical recording medium with which the light transmission layer with a thickness of 20-130 micrometers is prepared.

[0042] 20 micrometers of said minimum value have little telescopic motion according [the case of the thickness not more than this] to a temperature change, and is because it is not necessary to establish a curvature control means. Moreover, the maximum of 130 micrometers is determined from relation with the minimum clearance distance in which it approves between the distance of the objective lens of the optical head at the time of informational record/playback, and said recording layer 20, and this objective lens and optical recording medium 10.

[0043] Moreover, when there is little moisture absorption of the support base 12, or when there is little amount variation of curvatures by moisture absorption, it is not necessary to form said moisture absorption film 27 like the optical recording medium 40 of the 2nd example of the gestalt of operation of this invention shown in drawing 3 .

[0044] Furthermore, in the example of the gestalt of the above-mentioned implementation, although the curvature control layer 28 is formed in the field of the light transmission layer 24 and the opposite side of the support base 12 by uniform thickness, this invention may not be limited to this and may be other curvature control means. As it follows, for example, is shown in drawing 4 , the curvature control pattern 34 may be formed in the radiation direction with the ingredient long and same to a circumferencial direction at an equiangular distance as said curvature control layer 28.

[0045] In addition, polyolefine etc. may be used as an ingredient of said support base 12 in addition to a polycarbonate like the example of the gestalt of operation.

[0046] Moreover, especially the approach of formation of a curvature control layer is not limited, either, but an approach can apply variously a spin coat method, the roll coat method, screen printing, etc., and there is effectiveness of curvature control also in the printing layer performed using screen printing.

[0047]

[Example] When the example of the gestalt of operation shown in said drawing 1 and drawing 3 was shown in said drawing 2 in 20-22 degrees C and the environment of 50 - 60% of humidity after aging [examples / of a comparison / other / of 12 hours] the same optical recording medium at 80 degrees C, the variation of the amount of curvatures was measured by the same measuring method, and the axis of ordinate was set as the variation, the axis of abscissa was set as the time amount from measurement initiation, and it expressed to drawing 5 . In addition, the amount of curvatures immediately after taking out from under hot environments here was set to 0, and the difference from there was compared.

[0048] The example of a comparison for which the sign A of drawing 5 removed a curvature control layer and the moisture-proof film from the optical recording medium of drawing 1 , The example of a comparison for which B removed the curvature control layer from the optical recording medium of the example of the gestalt of operation of drawing 1 , The example as the optical recording medium of the example of the gestalt of operation of drawing 1 with same C, the example as the optical recording medium of drawing 3 with same D, and E remove a damp proof course from the optical recording medium of drawing 1 R> 1. Here as a curvature control layer It is the measured value of the example which printed in the ink of a

general pigment system to about 90% of field of the field of the shape of a doughnut with a diameter of 44-118mm of an optical recording medium with a diameter of 120mm.
[0049] As drawing 5 also shows, it turns out that contraction of a light transmission layer arises by heat dissipation within 10 minutes after measurement initiation, and it generates steeply [curvature] and greatly by this. Moreover, when it is C, D, and E in which the curvature control layer is prepared, it turns out that there is little variation of the amount of curvatures by the temperature change as compared with A and B.
[0050] Furthermore, if heat dissipation attains to the whole, the variation of the amount of curvatures will become large according to moisture absorption of the polycarbonate which distortion by heat leakage is canceled quickly, next constitutes a support base from a case of A, D, and E from 100 minutes to for 1000 minutes so that A, B, D, and E may see in [30 minutes -] 100 minutes in drawing 5 .
[0051] When it is B and C in which the damp proof course is prepared at this time, it turns out that change of the amount of curvatures by moisture absorption of a polycarbonate hardly arises.
[0052]
[Effect of the Invention] Since this invention was constituted as mentioned above, even if a steep temperature change occurs with a support base in the optical recording medium with which the comparatively thick light transmission layer is prepared, it has the outstanding effectiveness that the variation of the amount of curvatures generated by collapse of the stress balance by this temperature change can be controlled in constant value.

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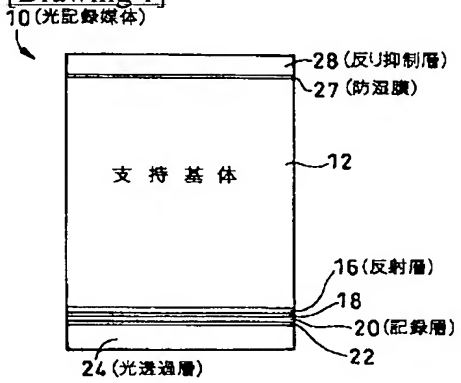
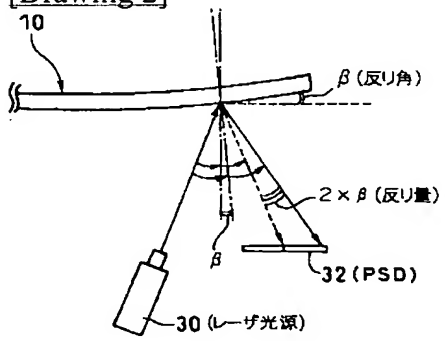
DRAWINGS

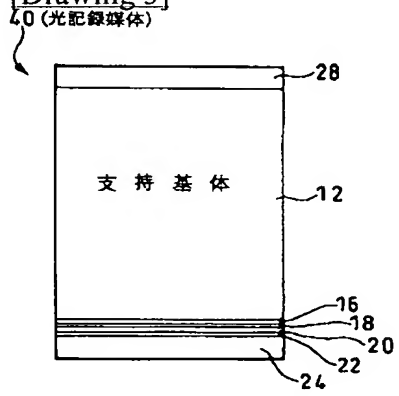
[Drawing 1]



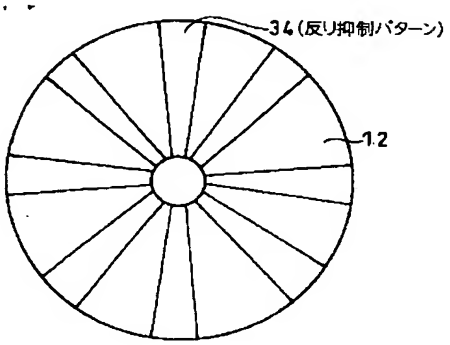
[Drawing 2]



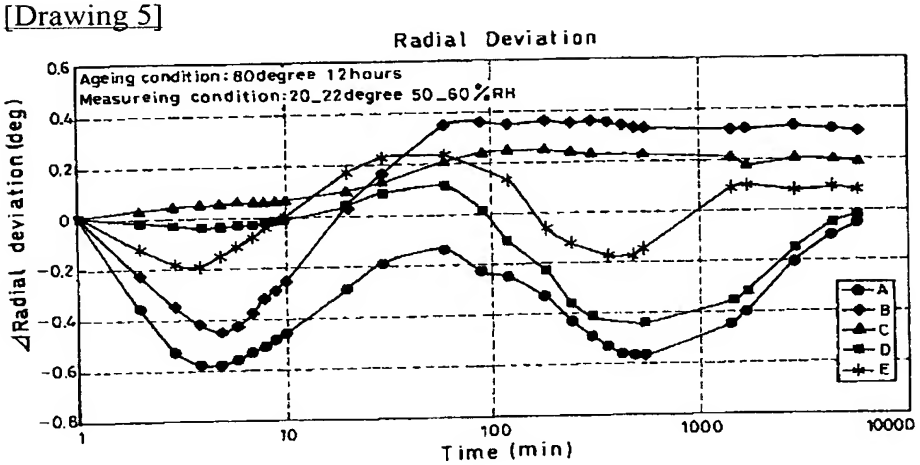
[Drawing 3]



[Drawing 4]



[Drawing 5]



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